ARI NEWSLETTER

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Night Vision Goggles In Focus:

Revised Procedures Improve Visual Acuity By 25%

"I can't see anything with these!" is a common reaction when a soldier with no training or experience wears night vision goggles (NVGs) for the first time. But with training on proper adjustment procedures, every soldier can learn to eliminate that initial, blurry image. And with additional field experience, soldiers find that the goggles are an invaluable asset during night operations.

To provide the ground soldier useable and definitive guidance on adjusting NVGs, we examined the effectiveness of using different field-expedient objects and of instructions on the proper adjustment procedures. These adjustment procedures were adapted from the latest aviation guidelines, which are more complete than those currently available to ground forces.

Soldiers need to see the best they can to maximize performance and to operate safely at night. NVGs definitely provide soldiers better vision, but it is not the sharp, 20/20 acuity experienced during daylight. Under optimum illumination conditions, NVGs can provide 20/35 or 20/40 acuity. When the light at night is poor, NVG acuity is decreased. And regardless of the degree of ambient illumination, soldiers will not obtain the best NVG acuity without proper training in NVG adjustment.

Recently, the aviation community took efforts to ensure that pilots adjust their goggles for maximum visual acuity before flight. Their procedures require that NVG controls be adjusted in a specific sequence. These procedures also use NVG test sets or special indoor visual charts when adjusting the diopter setting. But neither of these assessment techniques is feasible for field use by ground soldiers. First, test sets weigh too much. Also, visual acuity charts require a controlled light source. Therefore, there was a need to develop comparable effective procedures for field use.

Field-Expedient Objects and Test Equipment

Instead of using the heavy, expensive test sets, our experimental procedures used objects and equipment readily available to soldiers. These are shown in Figure 1 on page 3.

After soldiers adjusted their NVGs, we assessed their acuity with a special night vision goggle test set developed by Hoffman Engineering Corporation. The test set reticle is shown in Figure 2 (also on page 3). The numbers in the center of the squares are the second part of the standard Snellen resolution fraction, for example, the 25 pattern represents Snellen 20/25. The soldier indicated the square with the smallest number where both the vertical and horizontal bars were discernible. This reading was then the visual acuity of the system with the given adjustments.

see page 3

Inside:

Director's Message

Ideally, MANPRINT should be done as early as possible in the materiel development cycle in order to minimize false starts and result in the best product at the end of the line. However, many difficulties experienced in the field with today's high-technology equipment can be alleviated without making any changes to the equipment itself — by carefully studying the problem and improving training or procedures. The lead article in this Newsletter illustrates how that can work. In this case, soldiers learned to adjust Night Vision Goggles (NVGs) more effectively using field-expedient objects and improved procedures.

Another example of research on operational equipment is the "Air Warrior" article, which deals with the Aviation Life Support Equipment (ALSE) package. In this case, the proliferation of protective equipment has created problems with aircrew performance. ARI's research helped to create a baseline against which improved Air Warrior systems and components can be measured.

On the personnel side, this issue has two articles dealing with gender issues: gender-integrated training, and job satisfaction. Gender-integrated training, which ARI helped to assess in a 1995 study, resulted in improved basic training and physical training performance for both men and women. The study also confirmed the vital importance of drill sergeants in the success of gender-integrated training. Regarding job satisfaction, results from the Sample Survey of Military Personnel (SSMP), conducted semi-annually by ARI's Army Personnel Survey Office, reflect the complexity of career decisions. Job satisfaction is one factor, but its not, all by itself, strongly predictive of the decision to stay or leave.

Attrition in a more specific context, that of Special Forces, is discussed in another article. As with the SSMP, questionnaires were used to assess issues related to the Special Forces Assessment and Selection (SFAS) course. Consistent with previous findings, the results emphasize the importance of preparation — both mental and physical — for the challenges of SFAS. And, a key component of this preparation is provision of realistic information by recruiters.

Our productive working relationship with the United States Military Academy, through the Center for Leadership and Organizations Research, continues to provide new insights into the nature of leadership, as reflected by the article on transformational leadership. This topic was also the subject of a book recently published by ARI, "A New Paradigm of Leadership: An Inquiry into Transformational Leadership" by Bernard M. Bass. This is available from Defense Technical Information Center (accession number AD A306 579).

Taken all together, these articles once again bring out the breadth of the ARI program, dealing as it does with a wide range of issues from soldier performance through leadership theory, and from motivation and morale through performance enhancement.

Field Expedient Objects Investigated

Light Sources	Non-Light Sources
Stars	Tree trunk
Mini-blue chem lights *	Tree line
Mini-infrared (IR) chem light	Tree silhouetted against the night sky
Mini-red chem light	Vehicle - HMMWV
Flashlight with red filter	Camouflage net over shrubs
Flashlight with NVG compatible filter	Sandy vehicle trail in grassy terrain
Phoenix IR transmitter	White paper

***Viewed from near and far distances.**

Figure 1

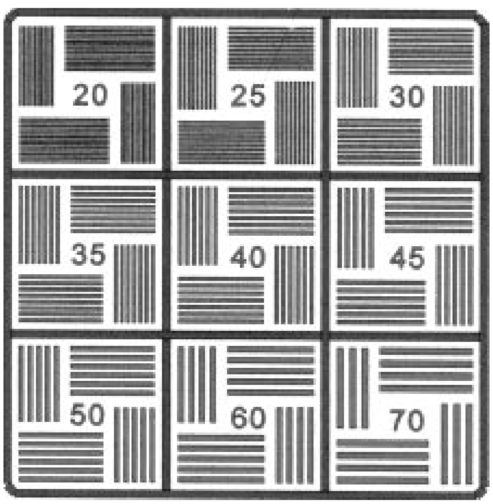


Figure 2

Recommended Procedures

The recommended procedures which emerged from our experiments are summarized in Figure 3 (see next page). Training and practice on these procedures improved visual acuity by at least 25%. In addition, the variability in acuity readings was reduced by two-thirds. And, there were no soldiers with blurry NVG images (20/70 visual acuity or worse).

The best readings were obtained with the tree trunk, vehicle, vehicle trail, IR and blue chem lights, and stars. Of these six objects, soldiers found that they could most easily and quickly determine when they had a sharp NVG image when viewing a tree trunk or a vehicle. The tree trunk, vehicle, stars, and vehicle trail were rated as the more usable in field environments. The chem lights were rated as less sound tactically because of potential light discipline problems.

Soldiers reacted negatively to red light sources, because of the large bloom produced in the goggles which was extremely hard to reduce. Other intense light sources (e.g., the Phoenix) created similar problems.

Nearly all soldiers (80%) indicated they could see better after using the procedures. They also reported learning something new about either the diopter adjustments or the eye span adjustments. As soldiers gained expertise in making the adjustments, they performed them very quickly.

In summary, good NVG acuity readings can be achieved with field-expedient objects when the soldier selects a high-contrast object or a non-intense light source. Training on proper adjustment procedures consistently eliminates extremely poor visual acuity settings and significantly improves the settings of soldiers with limited NVG experience. Consequently, performance and safety will be improved for every soldier, from vehicle driver to point man to rifleman.

For more information, contact Dr. Jean Dyer, Infantry Forces Research Unit, DSN 835-1278.

1. **Mount the NVGs.**
2. **Set the eye relief.** Move goggles close to eyes; eyepieces should not touch eyelashes or glasses.
3. Turn on the NVGs.

4. **Set the eye span.** Center each eyepiece over each eye.

➡ Pull the eyepieces as far apart as possible.

➡ Close one eye. For the open eye, move the eyepiece inward until the image is a full circle, not an oval. There should be no blurred images.

➡ Once one eyepiece is set, repeat the process with the other eye.

5. **Select an object to look at when adjusting the diopter rings and the objective lens focus.** Select objects which provide a high-contrast or light sources whose "bloom" can be reduced easily.

Recommended objects are:

- Tree trunk. Get within 5 feet of a tree trunk and look at the bark.
- Vehicle, positioned so you can distinguish sharp lines, corners, and other features.
- Vehicle trail that stands out in its environment (for example, a white sandy trail in the middle of a grassy field).
- Star.
- IR mini-chem light.
- Blue mini-chem light. Leave the wrapper on the chem and expose only the round end.

Objects not recommended are:

- Flashlight with a red filter.
- Red chem light.
- Phoenix transmitter.
- Flashlight with a NVG compatible filter.
- Tree silhouetted against the night sky.
- Piece of white paper.

6. **Set the objective lens focus.** Focus the goggles for the object's distance.

➡ Turn the objective lens focus to the right or to the left until the object you are looking at is as cle possible.

➡ If the object is beyond 30 ft, simply turn the objective lens focus to its full left or counterclockwis infinity position.

7. **Set the diopter adjustment ring for each eye.** These settings determine the visual acuity which can be obtained with the illumination available on a given night.

➡ First, close one eye (or cover eyepiece with eye cup) and adjust the diopter ring for the open e

➡ Turn the diopter adjustment ring to the left until it stops.

➡ Stop for a second, blink, and let your open eye relax.

➡ Repeat these procedures for the other eye.

For Non-light Sources

➡ Slowly turn the diopter adjustment ring back to the right until the object just becomes sharp. **STOP.** Do not turn the diopter ring beyond this point. Do not go beyond the initial clear focus.

For Light Sources

➡ Slowly turn the diopter adjustment ring to the right. **STOP** at the point where the bloom is minimized. If the light has a double bloom, that is, a center point of light and a larger surrounding bloom, turn the diopter ring until the center light source is as small as possible and the image is circular.

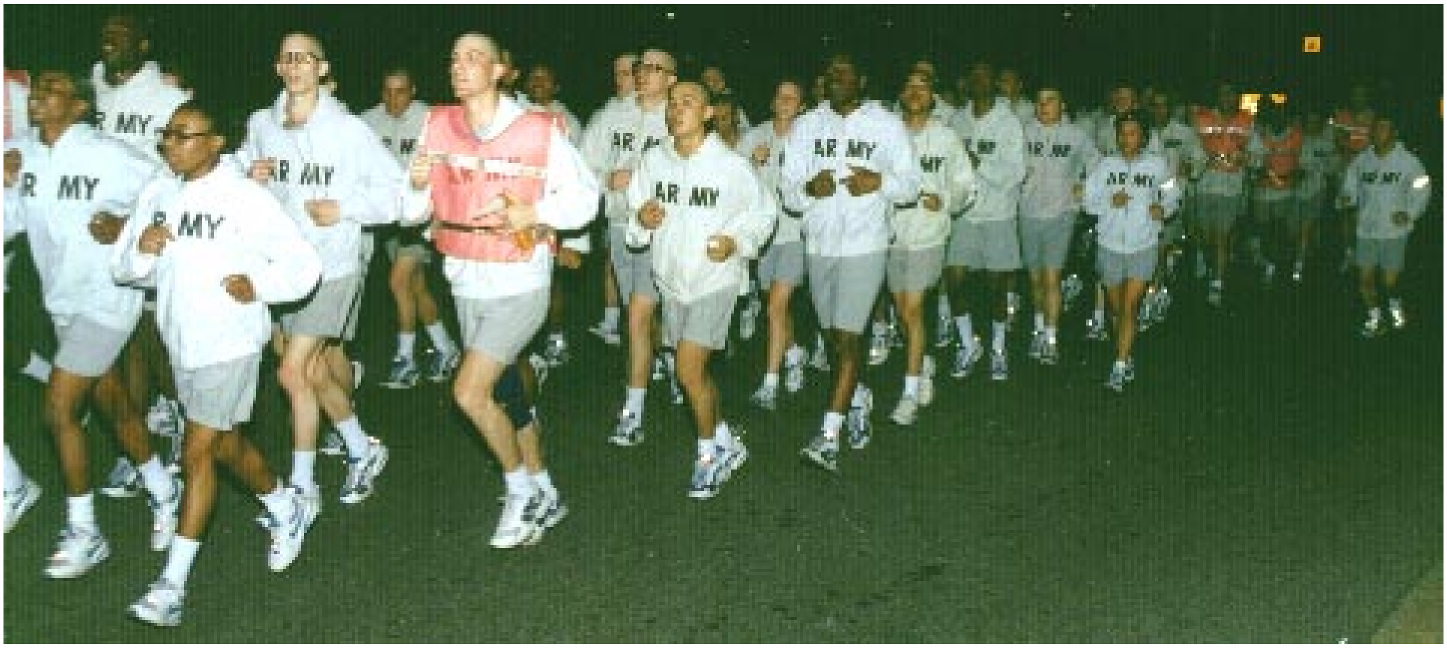
➡ Repeat these procedures for the other eye.

8. **Check the objective lens focus.** Ensure the distance focus is still sharpest. Adjust if necessary.

9. **Repeat steps 7 and 8 as necessary to determine if you have the best adjustment.**

Figure 3

Update On Gender-Integrated Basic Combat Training Study



The Women's Armed Services Integration Act of 1948 established the permanent status of women in the armed services. Since that time, changes to this policy have further defined the roles of men and women in the military. One such change occurred in 1994 when the Chief of Staff, Army ordered that Army Basic Combat Training (BCT) be conducted in a gender-integrated environment for soldiers entering Combat Support (CS) and Combat Service Support (CSS) military occupational specialties (MOS).

After the decision to conduct BCT in a gender-integrated environment was announced, the U.S. Army Training and Doctrine Command (TRADOC) established a steering committee (Gender-Integrated Training Steering Committee) to examine the conduct of BCT and to recommend whether, and how, training policies should be altered to assure the successful long-term implementation of gender-integrated BCT.

The study was conducted from April to September, 1995 at Fort Jackson, South Carolina and Fort Leonard Wood , Missouri. Four training companies from Fort Leonard Wood and six companies from Fort Jackson were included in the study. ARI administered a pre-training questionnaire at the reception battalions for soldiers, a post-training questionnaire for soldiers, and a post-training questionnaire for drill sergeants. ARI also conducted focus group discussions with all-male or all-female groups from each company and with male and female drill sergeants from each company. The 1995 study data were compared to data from the 1993 and 1994 studies.

Key Findings

ARI found that training in a gender-integrated environment improved the physical training performance (Army Physical Fitness Test scores on sit-ups, push-ups and run) of female soldiers in all three events and male soldiers in two of three events. For example, Figures 1-3 show the percent of male and female soldiers in single gender (SG) and gender-integrated (GI) training who scored at least 60 points in each event on the end-of-cycle Army Physical Fitness Test at BCT (50 points is passing at BTC, 60 points is the Army standard).

ARI also found that the preparation of Drill Sergeants—especially training Drill Sergeants to work with and train female soldiers—and chain of command support are keys to the success of gender-integrated training.

Sharing Lessons Learned

Data from the study were briefed to the Steering Committee and to the Assistant Secretary of the Army (Manpower and Reserve Affairs) in January 1996. Data were reviewed by the Government Accounting Office

(GAO Report to the Chairman, Subcommittee on Military Personnel, Committee on National Security, House of Representatives, June 1996) and were included in Army testimony for the Subcommittee.

The Army is using the data to improve drill sergeants' training and to prepare leaders attending pre-command courses. ARI is also working with the training centers to develop a BCT handbook for recruits.

For more information, contact Dr. Jacqueline A. Mottern, Army Personnel Survey Office, DSN 767-7805, Commerical (703) 617-7805.

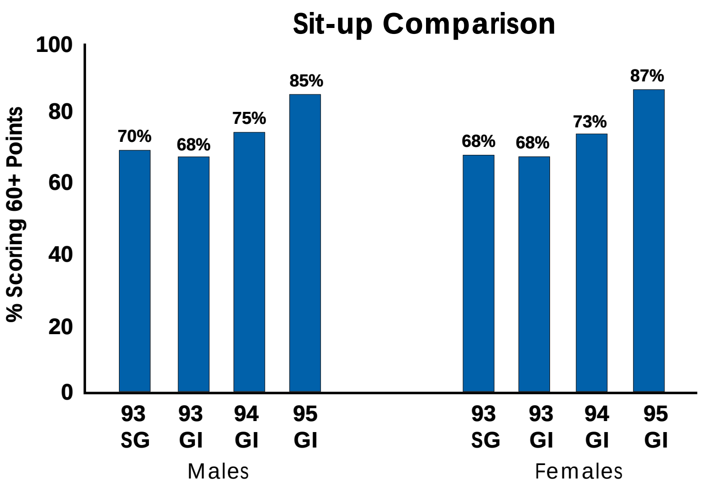


Figure 1

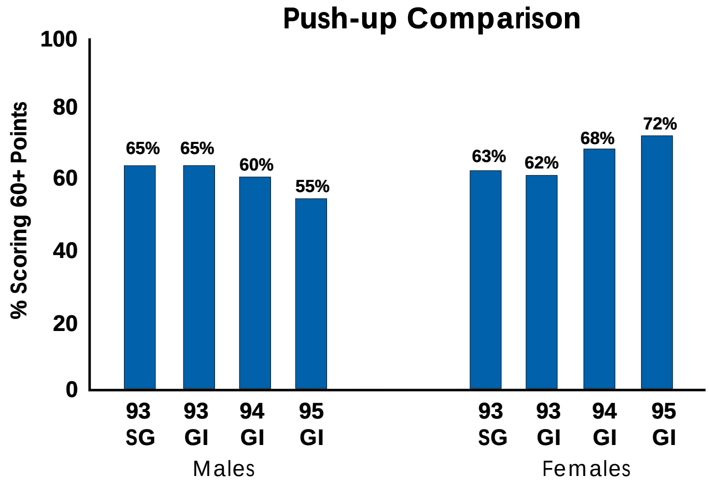


Figure 2

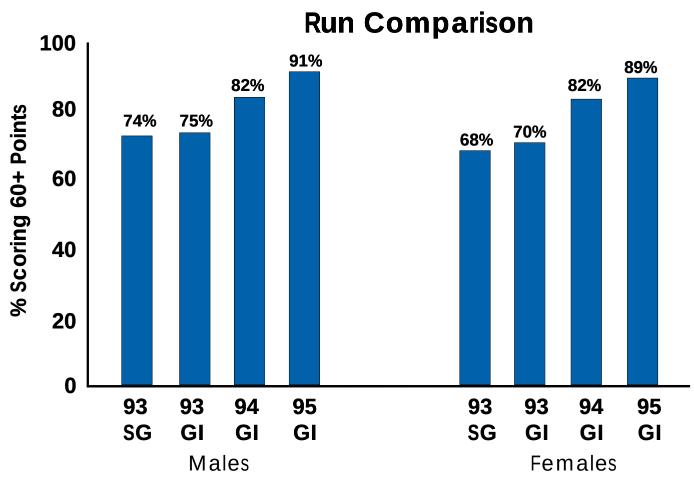


Figure 3

Are There Gender Differences in Job Satisfaction?

The Sample Survey of Military Personnel (SSMP) is an Army-wide survey, authorized by AR 600-46 and conducted for the HQDA Deputy Chief of Staff for Personnel (DCSPER). It is an omnibus survey designed to address many different issues important to the Army, soldiers, and their dependent family members.

*T*he Army Personnel Survey Office, U.S. Army Research Institute for the Behavioral and Social Sciences, conducts the SSMP semi-annually in the spring and fall. Samples of approximately 10% of officers and 2-3% of enlisted personnel are randomly selected to receive the survey.

At the request of the DCSPER, the Spring 1995 SSMP focused on gender differences in job satisfaction. The survey was fielded in May of 1995 to an expanded Army-wide sample of officers and enlisted personnel and was designed to collect detailed information on job satisfaction. Findings reported in this article are based on responses from 3,565 male officers, 4,553 female officers, 4,172 male enlisted personnel, and 2,823 female enlisted personnel who responded to the survey between 8 May 1995 and 30 September 1995.

Of the 15 areas of job satisfaction (comprised of over 200 individual items) covered by the survey, there were few (if any) differences between males and females in the following areas:

- Stress
- Global Satisfaction
- Promotion Potential
- Job Security (enlisted only)
- Job Characteristics (officers only)

The remaining areas of job satisfaction differed as follows:

Females more positive about:

- Benefits
- Family
- Equity
- Basic Pay
- Job Security (officers only)
- Job Characteristics (enlisted only)

Males more positive about:

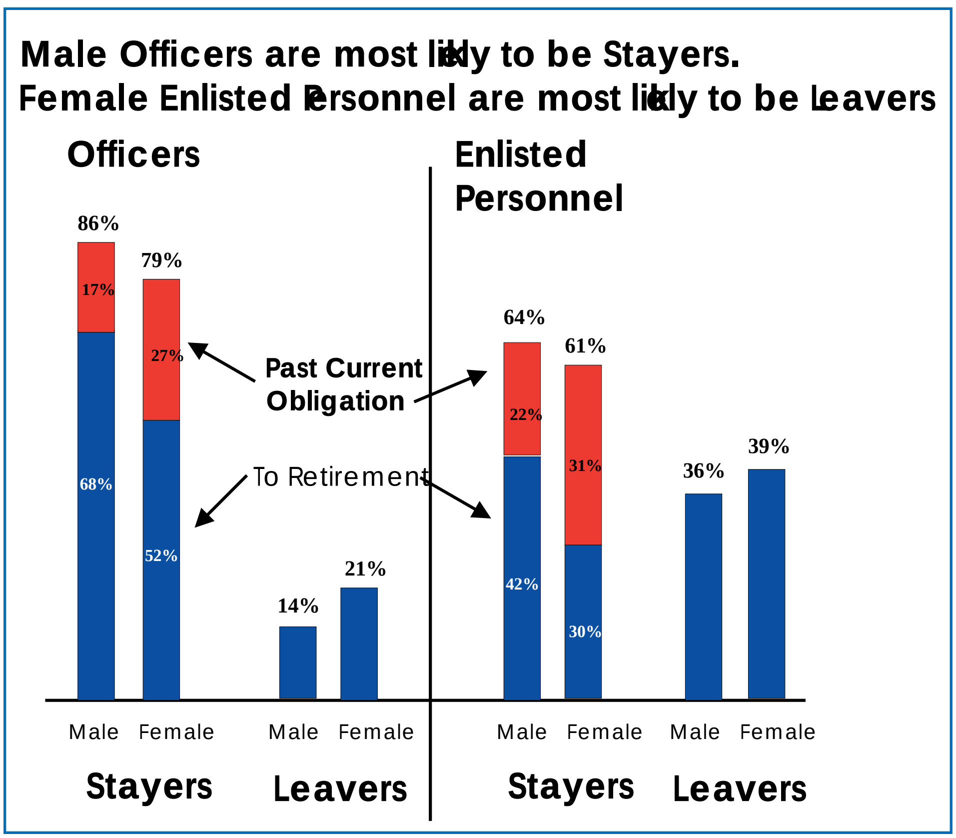
- Co-workers
- Supervisors
- Leadership
- Developmental Courses
- Absence from Duty

Career Intent

The percentages of soldiers reporting that they will probably or definitely stay until retirement have been stable since the Spring of 1992 (findings from the Spring 1995 SSMP are shown in the Figure). Male officers are most likely to report that they plan to stay to retirement (ranging from 68% to 71% since Spring of 1992), followed by female officers (ranging from 46% to 52%), male enlisted personnel (ranging from 41% to 43%), and female enlisted personnel (ranging from 28% to 33%).

Results from the survey have not identified any clear-cut relationships between job satisfaction and career intent for males or females. This may be due, in part, to the fact that some soldiers who are "leavers" report that they are satisfied or very satisfied with a number of the items used to assess job satisfaction. A substantial percentage of leavers report that they are satisfied with the quality of Army life (34%-enlisted males, 40%-enlisted females, 48%-female officers, and 60%-male officers), their Army career (31%, 34%, 47%, and 51%), and report that their spouse is supportive or very supportive of them making a career of the Army (34%, 43%, 43%, and 51%). It appears from the survey results that the decision to stay in or leave the Army is based on a series of very complex issues which, in many cases, are unique to the soldier making the decision. Job satisfaction alone does not appear to be a very good predictor of career intent.

For further information contact June Taylor Jones, Army Personnel Survey Office, DSN 767-7807,



Note: Soldiers who report they will probably or definitely stay past their current obligation are considered "stayers" (along with those reporting they will stay to retirement) because the longer a soldier stays in the Army, the more likely he or she will stay until retirement.

Air Warrior

Introduction

Army aircrews play a critical role on the combined arms battlefield. The range and lethality of their weapons systems can be critical in defeating opposing forces. To accomplish their missions, Army aviators must operate flight controls of complex aircraft in a precise manner while directing complex weapons systems. They are faced with the prospect of mechanical failure and are exposed to enemy threats designed to knock their aircraft out of the sky. Given the difficulties that they face, their task becomes even more daunting when the operational environment contains a nuclear, biological, or chemical (NBC) threat. To protect the force against such threats, a host of protective measures has been developed. These include a protective mask, a chemical protective hood and overgarment, overboots, and thick rubber gloves. Additional components of the Aviation Life Support Equipment (ALSE) package include a bulky ballistic protective vest and, for flight over water, an air cylinder for breathing, a life raft, and water wings. As is apparent in Figure 1, this array of protective gear presents its own set of problems. The nature of these problems are stated in the Operational Requirements Document (ORD) for an improved set of ALSE equipment, called Air Warrior:

> *Over the years, aviation life support, protective, survival, and operational support equipment, and clothing were developed as separate entities and fitted to aircrews and aircraft as space dictated. The lack of effective integration of these items of equipment, and excessive layering of multiple items (e.g. life raft, survival vest, flak vest, etc.), has resulted in aircrews being furnished with an ensemble of equipment that is heavy and bulky and constitutes a physical and physiological burden, especially when protecting against worst-case threat scenarios. This physical burden degrades aircrews' effectiveness by hastening the onset and increasing the levels of fatigue, reducing mobility, limiting visibility, and restricting their ability to safely fly the aircraft and perform mission functions.*
>
> *(Operational Requirements Document for Air Warrior, dated 19 March 1996).*

Figure 1

Air Warrior Program

To rectify these problems, the Project Manager for Aircrew Integrated Systems (PM ACIS) of the Program Executive Office - Aviation (PEO AVN) established the Air Warrior acquisition program. The goal of Air Warrior is to fix current ensemble problems and acquire a systems engineered, integrated protective ensemble.

Evaluation Process Simulation Support

Simulation Paramaters

- **Define Parameters**
  - •Review Test Data
  - •Identify Pertinent Measurement Parameters
  - •Develop Measurement Methods
- **Define Scenario**
  - •Based on User Inputs, RPA, AH-64, and RAH- 66
  - •Designed to Exercise Parameters

Baseline Evaluation

- Run Simulations of Unencumbered Pilot
- Run Simulations of MOPP4+ Pilot
- Report Result Comparisons
- Report Suggested Design Goals Based on Results

AW Concept Alternative Evaluations

- Run Simulations on AW Alternatives

Figure 2

As illustrated in Figure 2, the PM ACIS decided that mission simulation would play a major role in the Air Warrior program evaluation. Simulation was thought to benefit the program in two ways. Initially, mission simulations could define the areas of crew performance and mission effectiveness which are degraded by the current ensemble. In this way, the program could focus on the components of the current gear which detract the most from performance. Once fixes are determined and prototypes for Air Warrior integrated systems are defined, mission simulations can be used as a testing ground for the improvements.

ARI's Role In Air Warrior

The important first step in this process was the identification of a suitable simulation facility in which to carry out both the first objective of identifying the detractions brought about by the current ensemble and to define a testbed for future Air Warrior prototypes. In 1995, the PM ACIS determined that the Simulator Training Research Advanced Testbed for Aviation (STRATA), which replicates the AH-64 Apache attack helicopter and its tactical environment, met these requirements. STRATA was designated the primary simulation test site for the Air Warrior program. Throughout 1995, and continuing in 1996, a series of experiments was carried out in STRATA. The objective of these experiments was the creation of a baseline to determine the human performance consequences of the current ensemble and to point out areas requiring attention. This baseline condition will be used to evaluate future Air Warrior conceptual and prototype ensembles in STRATA. The initial "quick-look" simulation used only pilots in the AH-64 rear crew station flying a non-combat mission of typical flight maneuvers while firing on fixed targets similar to those found on firing ranges. The quick-look was followed by a series of full crew combat mission simulations during which the missions, measures, and analyses were refined into their final form used for the baseline Air Warrior simulations.

Initial Quick-look

ARI conducted the quick-look experiment during the Summer of 1995. The goal of the quick-look experiment was to check experimental manipulations and validate the mission profiles and performance measures. In addition, this experiment permitted an examination of the consequences of wearing the ensemble for performance of piloting tasks.

For the quick-look, the STRATA AH-64A pilot crew station (the aft cockpit) was used. All missions were flown under day conditions. A mission profile, adapted from previous STRATA experimentation, was flown four times by five AH-64A pilots and by three pilots not rated in the AH-64. Two conditions were employed: Unencumbered - without the NBC ensemble, and Encumbered - with the NBC ensemble. Outcome measures consisted of automated performance measures of aircraft states, control use, helmet angles, and weapon firing accuracies.

The findings of the quick-look research indicate performance degradation due to the ensemble. The trend was for performance to be superior when the pilot was unencumbered by the ALSE equipment. For example, the pilot showed an altitude range of 1.38 feet when encumbered, during the stationary hover, while the altitude range during the unencumbered condition was .78 feet. Lateral movement (the tendency to drift right or left) for the hover task averaged 1.8 meters when unencumbered, but jumped to an average of 5.13 meters when the pilot carried out the hover task wearing the ensemble. Due to too few observations, this latter comparison is not statistically significant; however, the trend does indicate a possible hazardous condition for hovering the aircraft when the pilot is encumbered by the ensemble. These and other data indicated that there was greater movement of the aircraft along the longitudinal and vertical axes during hover when the pilot was wearing the ensemble. The quick-look experiment also set the stage for the larger mission performance data collection effort involving full Apache crews.

Mission Experiment

Following the quick-look data collection, ARI carried out an extensive effort to investigate the effect that wearing the ensemble would have upon crews operating the Apache attack helicopter during typical missions. For this experiment, seven AH-64 crews flew four combination daylight and night combat mission scenarios encumbered and the same four scenarios unencumbered. As with the quick-look, these mission simulations were conducted at Fort Rucker in the STRATA simulator. The order of flying encumbered or unencumbered was counterbalanced, and threat element dispositions were varied between the first and second repetitions of each scenario. Data were recorded during the simulated flights for 50 different parameters reflecting the state of the vehicle and its flight controls and switches, pilot helmet angles, threats line of sight, and the accuracy and effect of each weapon round fired. In addition, crewmembers were asked to rate the level of six different aspects of workload (the TLX Task Load Index) during various phases of the mission.

The results of the mission experiment indicate that the current set of NBC gear led to substantial difficulty in performing many of the critical tasks required of Apache aircrews. The following are just a few of the consequences for mission performance.

Pilot subjective opinions in workload estimates and their debriefing comments indicate that the encumbered condition increased their workload substantially. Workload estimates for the encumbered condition were higher consistently for all TLX aspects of workload in all mission phases. In addition, the equipment caused substantial pain for most crewmembers on most missions. The most common source of pain, "hot spots," was evident from points, lines and areas of red welts on the scalp that usually lasted well beyond an hour after the mission. In terms of crew proficiency, wearing NBC gear increased the mean time to set radio frequencies by 185% (123 versus 43 seconds), and median time by 126% (81 versus 36 seconds). Aside from these workload, discomfort, and accuracy degradations, the current NBC ensemble detracted from perceptual and motor ability due to the lack of visual clarity and field of view brought about by the mask. Pilots reported that these visual problems required them to engage in strategies which were different from the methods they would ordinarily employ while operating the aircraft and weapon system in normal flight gear.

Major effects of the current array of ALSE equipment on objective measures of crew performance were found mainly for crew station procedures involving both vision of, and fingertip manipulation of, control panel items. The current ensemble also was found to produce major limitations in the rotation of the helmet during high turn rate maneuvers. Figure 3 shows the differences in pilot head rotation, in degrees, between the encumbered and unencumbered conditions. These data reveal the restriction in the range of head motion which resulted when the crews wore the NBC ensemble. Such restrictions impede the ability of the crew to see objects out of the aircraft. These restrictions have major consequences for safety of flight and mission performance.

The precision of flight control maneuvering was found to be reduced when the crew wore the NBC ensemble. This point is illustrated by the data in Figure 4 showing the restriction in range of aft cyclic control movement for the encumbered condition when compared to the unencumbered condition across the range of crew

MEASURE Mission Segment/Maneuver Statistic	Unencumbered (Deg)	Encumbered (Deg)	RATIO IN % (NBC / STD)
PILOT HELMET AZIMUTH			
Engage at BP (During Night Mission) Range	96.2	59.0	61*
120 kt at 100 ft (During Night Mission) Range	44.3	25.4	57**
Initial Egress (During Night Mission) Range	52.1	36.5	70**
FAA Approach (During Night Mission) Range	55.8	13.0	23**
Evasive Quick Turn (Before Night Mission) Range	42.4	30.9	73**
Evasive Quick Turn (After Night Mission) Range	43.5	32.7	75**
PILOT HELMET ELEVATION			
Fly to Battle Position (During Night Mission) Range	12.5	26.9	215**
Evasive Quick Turn (Before Night Mission) Mean	-2.3	-4.7	205**
Evasive Quick Turn (After Night Mission) Mean	-1.9	-4.6	238*
180 Autorotation (After Night Mission) Mean	-2.0	-5.5	274**

*Difference significant at $p < 0.05$; ** Difference significant at $p < 0.01$

Figure 3
Ensemble Effect on Rotation of Pilot's Helmet During Maneuvers (Minus Values Are Rotation to the Left)

	Crew Anthropometry Motion Limitation Percentiles									
	Smallest									Largest
	2	5	10	25	50	75	90	95	98	100
	Aft Motion Available from Cyclic Trim Position									
Unencumbered	100%	100%	100%	100%	100%	99%	97%	92%	90%	77%
Encumbered	74%	66%	62%	49%	40%	29%	20%	11%	6%	1%

Figure 4

Percent of Available Aft Cycle Motion for Trim Conditions During Hover.

anthropometry for hover. Figure 4 shows, for example, that the smallest crews could move the cyclic through 100% of its available AFT range when they were unencumbered, but only had 74% of the aft cyclic control authority when encumbered. For the largest crews the prospects for safe control are poor. Crews in the largest category could only move the cyclic 1% of its available range when encumbered, while they could move the control up to 77% of its range when not wearing the gear. This limited AFT cycle motionprecluded normal airspeed decelerations and normal hovering flight. As with restricted head movements, the inability to move a primary flight control has strong potential for disaster and compromises safety.

Aircrew workload estimates were much higher when flying encumbered. Crews indicated they had to shift from a primary focus on mission performance when unencumbered, to much higher levels of attention and effort in dealing with the demands and frustrations of the ensemble when flying encumbered.

Conclusion And Future Prospects

The STRATA Air Warrior baseline simulation results and experience provide a solid foundation for conducting future simulations to evaluate the performance effects of improved Air Warrior systems and components. The simulation methodology, missions, maneuvers, tasks, measures, and analyses appear to be effective for evaluating the performance effects of Air Warrior development products. The results and experience from conducting these baseline simulations allow future simulations to be conducted efficiently and tailored to focus on specific issues when required.

For further information, contact the Rotary Wing Aviation Research Unit Chief, Mr. Charles A. Gainer, (334) 255-2834 or the Aircrew Performance Team Leader, Dr. Dennis C. Wightman, (334) 255-2873.

Transformational Leadership And Follower Development

U.S. Army doctrine emphasizes the need for units capable of engaging complex problems independently and yet within the vision of the military mission. This emphasis requires leaders and followers with high levels of both skill and will.

A recent paradigm, developed by Bernard M. Bass and his associates, identifies a leadership approach likely to develop the needed levels of skill and will. This paradigm distinguishes between transactional and transformational leadership. Transactional leadership involves exchanges between leaders and followers which reflect more traditional forms of "management by objectives." In transactional exchanges, leaders specify requirements and the conditions and rewards for fulfilling those requirements. According to the paradigm, such exchanges can have positive effects on followers; however, transformational leadership achieves levels of effects over and above those produced by transactional exchanges. These augmenting effects are achieved through the following types of transformational behaviors: behaving so as to become a role model which followers want to emulate; providing meaning and challenge so as to inspire commitment to goals beyond self interest and to a shared vision; encouraging new ways of thinking, new approaches to problems, and learning from mistakes; and paying attention to each individual's particular needs, desires, and capabilities. Bass and his fellow researchers have developed questionnaire measures of transformational and transactional leadership behavior.

The Center for Leadership and Organizations Research (CLOR), jointly operated at West Point by the United States Military Academy and the Army Research Institute, is administering the measures of transformational and transactional leadership for inclusion in the Baseline Officer Longitudinal Data Set (BOLDS). Beginning with entering leaders, the BOLDS will describe the leadership of officers over the course of their careers as organizational leaders. In addition to transactional and transformational leadership, the BOLDS will describe leadership in other ways, to include problem-solving capabilities, knowledge of leadership, and a leader's self identity.

As it assembles the BOLDS, the CLOR is also conducting research to test the expected effects of transformational leadership on followers. In one test, data were collected on the officers and platoon members in the chains of command of 41 Army battalions located at six installations in the U.S. Subordinates rated the leadership of their immediately superior officer in the chain of command (e.g., platoon members rated their platoon leader and platoon leaders rated their company commander). The followers of all leaders rated their own motivation to perform; platoon members provided additional ratings of their own organizational commitment and of the cohesiveness of their platoon.

As indicated by the paradigm, transactional leadership significantly and positively predicted all outcomes investigated: motivation, organizational commitment, and perceived platoon cohesiveness. As also hypothesized, transformational leadership augmented the effects of transactional leadership in that the prediction was even stronger by adding transformational leadership to the prediction equation. Especially noteworthy were the effects of transformational leadership by level of leadership. The two separate measures of motivation (job motivation and willingness to extend extra effort) showed the same pattern: the augmentation effects of transformational leadership were relatively greater for company commanders and battalion commanders than for platoon leaders. Ratings also indicated that company commanders and battalion commanders displayed transformational behaviors more frequently than did platoon leaders.

These results support the new paradigm of leadership, and indicate the value of distinguishing transformational from transactional forms of leadership. One value of this distinction appears to be the relatively greater and positive effects of transformational leadership on the development of followers, as indicated by the motivation, commitment, and cohesiveness of unit members. The results also suggest that transformational leadership is more important at leadership levels higher than the platoon level. As it assembles data over the careers of leaders, the BOLDS will provide a data base capability for identifying further the levels of leadership at which transformational leadership is most important, the relationships between transformational leadership and other leadership measures, and the factors that enable leaders to become transformational.

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Special Forces Assessment and Selection Attrition Analysis

Due to several recent changes in the Special Forces Assessment and Selection (SFAS) course at Fort Bragg, and concern about changes in attrition rates, the Commandant of the Special Warfare Center and School (SWCS) asked ARI to collect data and answer questions related to certain key issues. The project became a collaborative effort between ARI and SWCS. This article provides some of the key findings from the project. The issues of concern were: (1) Demographic changes in the composition of current SFAS classes relative to past classes; (2) Candidate attitudes toward the cadre; (3) Candidate preparation for land navigation; (4) Land navigation training; (5) Chain of command support for application to SFAS; and (6) Recruiting for SFAS.

Questionnaires were developed by ARI based on these issues, and several additional questions were incorporated from previous ARI research related to these issues so that comparisons could be made with previous classes. Draft questionnaires were reviewed by the SFAS chain of command to ensure that all of their concerns were addressed.

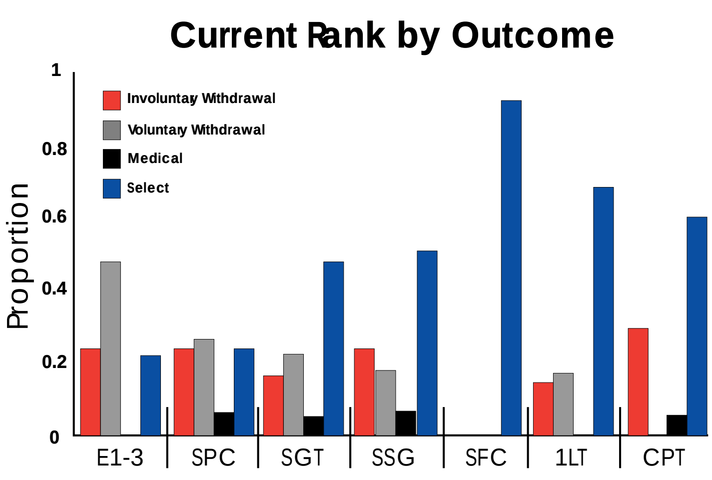

Figure 1

The Entry Questionnaires were given to all candidates entering SFAS in two consecutive classes (4th quarter FY95 and 1st quarter FY96) representing a total of 641 candidates. An Exit Survey was given to all candidates as they departed the course in one of the four following **outcome categories**: (1) **Involuntary Withdrawal (IVW)** - dropped due to Physical Fitness Test or Swim Test failure, board drops, or cadre drops during team week; (2) **Voluntary Withdrawal (VW)** - personal decision to withdraw; (3) **Medical** - dropped from class due to medical reasons; or (4) **Select** - completed all requirements for SFAS. Of the candidates entering each class, 95-96 % completed the Exit Survey.

The results of the analyses indicated that the percentage of candidates from combat arms MOSs was consistent across the two classes, approximately 60%. Combat arms MOSs are typically associated with a higher select rate and lower VW rate than the non-combat arms MOSs. In these classes the select rate of 46 % of Active Duty candidates is consistent with findings from earlier classes, but as can be seen in Figure 1 there is a good deal of variability in success rates across candidate ranks. Generally speaking, lower ranking soldiers do not succeed at the same rate as NCOs with more experience and maturity.

The candidates in both classes, regardless of outcome category, generally describe the cadre as being very fair and professional, state that the standards were fair and consistent, and report that they were treated fairly and with respect.

In terms of being mentally and physically prepared for SFAS, some interesting points can be drawn from the data: (1) Approximately 74 % of the soldiers in the two classes thought that they were physically prepared for SFAS as they began the course. (2) As can be seen in Figure 2, VWs reported a slightly lower physical preparation level than did the other outcome categories in the Exit Survey.

It appears that many of the candidates overrated their preparation level prior to starting the course. Since most of the candidates are first-time attendees, the recruiters are the primary contacts for information on SFAS. The recruiters must therefore provide information that will prepare the candidates for SFAS. Two previously produced ARI products, “PT Handbook” and “Thinking about Special Forces,” contain the best information available about how to prepare for SFAS. These pamphlets also provide a “realistic job preview” so that soldiers who apply after reading these materials are likely to know what to expect in SFAS and Special Forces in general. Therefore these soldiers are less likely to voluntarily withdraw from SFAS. The questionnaire revealed that about 40% of the candidates received the PT Handbook and about 50% received the “Thinking about Special Forces” handbook prior to coming to SFAS.

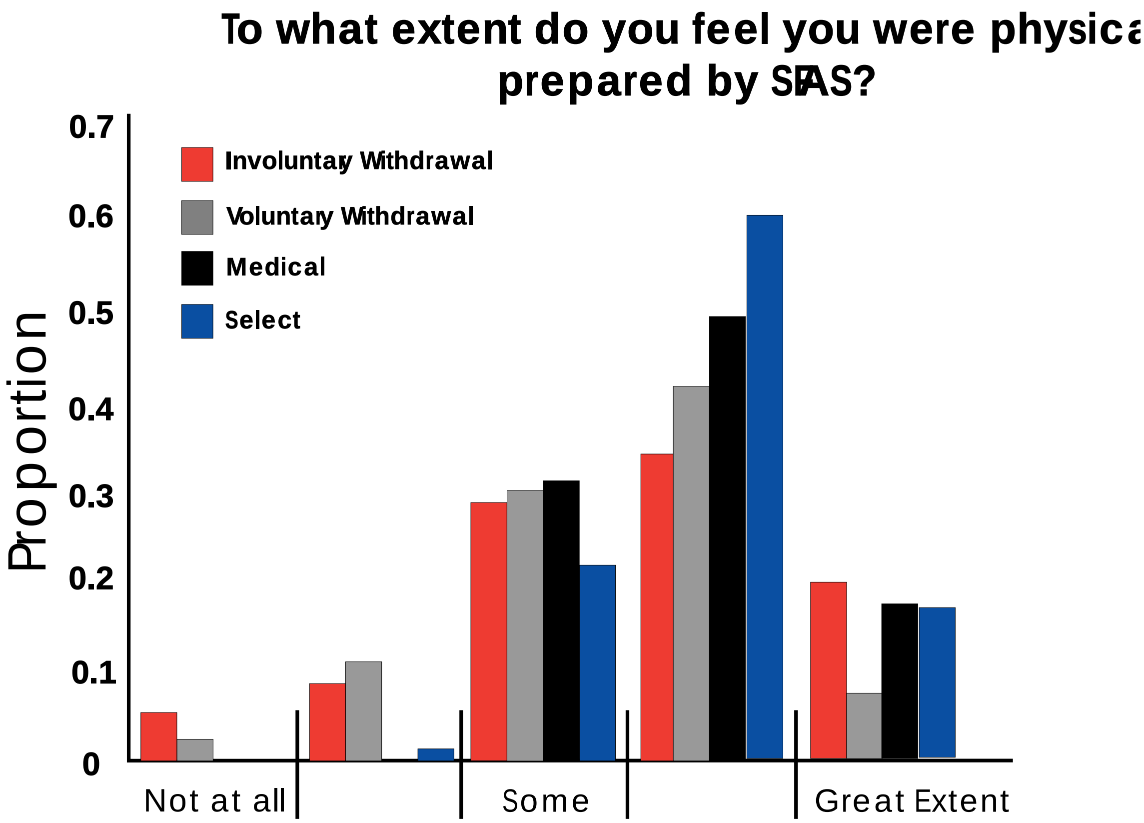

Figure 2

Soldiers who understand the requirements and pursue the preparatory training program have a greater chance of completing SFAS. The recruiters have the responsibility of arming the candidates with the information essential for their success. It was recommended that recruiters promote long distance ruck marching and land navigation with rucks (day and night). This kind of practice prepares soldiers for the rigors of SFAS and it also provides potential candidates with their own job sample test. Some of the potential candidates who try this realistic training will decide early on that this combination of activities is not for them and will select out of further application. Those candidates who continue the process and go to SFAS will be more likely to complete the course.

The results for chain of command support for application to SFAS indicated that roughly 55-60% of the candidates thought that the chain of command was "Supportive" or "Very Supportive" of their application. Typically, 10% of the applicants indicate that their chain of command was "Not Supportive At All", but the responses from the two classes evaluated showed a trend toward improvement in that category with 7% and 5% so indicating. However, if 5-7% of the candidates reported lack of support, it is possible that other candidates were not supported [discouraged] to the point of dropping their application. One could also speculate that individuals within a potential recruit's chain of command might give less support to talented soldiers so that the talent would stay in their unit.

In summary, several recommendations were made related to ensuring that recruiters provide the best and most realistic information available to potential candidates. A recommendation was made that recruits be advised to practice the tasks they will confront in SFAS, such as long distance rucking while land navigating day and night. It was also recommended that the recruiters' mission requirements be based on candidates' successful completion of the early stages of SFAS instead of being based on the number of candidates that arrive at SFAS. This practice will enhance the likelihood that candidates will have a realistic preview of what SFAS will be like, and that early exposure to these tasks will aid potential candidates in determining their preparation level. Biographical data items are also being developed and evaluated as potential tools to assist in the prescreening of candidates and the identification of high potential candidates. The SWCS command is acting on several of the results and recommendations from this analysis.

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